PTO 087-1838

CC=SE DATE=19971027 KIND=Patent
PN=9603040-8

METHOD FOR PRODUCING BUILDING BLOCKS OF COMPRESSED STRAW
[Förfarande för att tillverka byggblock av komprimerad halm]

Anders Hellsten

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. January 2008

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(19):	SE
DOCUMENT NUMBER	(11):	9603040-8
DOCUMENT KIND	(12):	Patent
PUBLICATION DATE	(43):	19971027
APPLICATION NUMBER	(21):	9603040-8
DATE OF FILING	(22):	19960822
ADDITION TO	(61):	
INTERNATIONAL CLASSIFICATION	(51):	B27N 3/00, E04C 2/10, 2/18
PRIORITY	(30):	
INVENTORS	(72):	HELLSTEN, ANDERS
APPLICANT	(71):	HELLSTEN, ANDERS
DESIGNATED CONTRACTING STATES	(81):	
TITLE	(54):	METHOD FOR PRODUCING BUILDING BLOCKS OF COMPRESSED STRAW
FOREIGN TITLE	[54A]:	FÖRFARANDE FÖR ATT TILLVERKA BYGGBLOCK AV KOMPRIMERAD HALM

SPECIFICATION /1*

1. Title

Method for Producing Building Blocks of Compressed Straw

The present invention concerns a method for producing blocks intended for building purposes. They can be used both as bearing structures and as insulation at the same time. The blocks are produced by heating and pressing together straw from plants, e.g., oats, rye, wheat, barley, rice, or flax that remains stable after cooling.

Straw from various kinds of plants is a building material that has been used for a very long time. An example is blocks of sun-dried clay with straw baked in for insulation and reinforcement. Another example from our latitudes is straw roofs. A more modern variant has been tested as a building material. Here, straw is pressed together into plates that are used as such as a wall covering. The disadvantage of these is that the stalks lie arranged in layers, and this leads to the plates cracking when they are stressed. In addition, they cannot be made especially thick. This also means that the method cannot be used for building blocks. The plates certainly have a good resistance to heat, and they should therefore be able to be used for insulation, but the low thickness means that several plates must be used on top of one another in order to have any effect. Since the plates have limited strength, a problem arises when they are placed together. One way of increasing strength in plates is to use cement as a binding agent. The disadvantage here is that the plates become extremely heavy with the cement. The cement also makes the straw lose

* Numbers in the margin indicate pagination in the foreign text.

some its insulating properties.

Another way than cement for achieving a binding between stalks of straw is to heat them up to about 100 °C and then compress them. The straw stalks are then "glued" together with the aid of the binding agent that is found naturally in straw. The disadvantages of cement are thereby avoided. A description of this is found in patent WO 80/02835.

Today, rock wool is used as an insulating material. Research experience indicates, however, that rock wool can contribute, among other things, to silicosis, due to small rock-wool fibers being able to penetrate into lung tissues. Compressed straw can then be an alternative, since, on the one hand, it has good heat values, and, on the other hand, it does not contain small fibers.

With the present invention, building blocks can be produced that can be used as both bearing building elements and as insulation. In addition, they have a strength that is at the level that wood has. The strength can be changed by varying the density of the blocks. The blocks also receive good hygroscopic properties, which means that a good interior climate is obtained as is found in buildings of timber, etc. The blocks also do not give off small particles that can damage the lungs.

Description of the diagrams

Figure 1 Description of equipment for feeding straw, consisting of a feed plate and a ball grinder.

Figure 2 Description of equipment for obtaining an even flow of unorganized straw stalks for feeding and cold-compressing.

Figure 3 Description of equipment for feeding and cold-compressing with

crosscutting.

Figure 4 Detailed description of equipment for feeding and cold-compressing.

Figures 1-4 are shown in side views.

Figure 5 Description of heating, warm-compressing, and cooling in side view above and a top view below.

Figure 6 Description of stacking and packaging, top view.

The starting material for building blocks is straw from plants /2 that contain a binding agent that can bind the individual stalks to one another. A practical example is the straw that is left behind after a scoop has harvested the seeds. Today, they can be collected together into rolls are balls measuring, e.g., 1600 x 1200 [mm] in diameter and then transported to the equipment described below. The balls (11) in Figure 1 are placed on a buffer table (12), where the cords that hold them together are removed. A ball grinder of standard type (13), where the balls are rotated, then divides the straw by means of a sliding plate (14) to conveyor equipment, Figure 2. This consists of a conveyor belt (21), driven by a motor roller, equipped with a weighing unit (22). The conveyor belt rotates clockwise according to the diagram. The ball grinder (13) can have difficulty in giving an even flow of straw, which is important for further processing. For this, there is a return device (23). This consist of a number of pegs (24) that sit next to one another on a rod (25) that rotates clockwise with the aid of a motor (26). The rotating pegs fling the straw up by means of plates (34) onto the upper conveyor belt (27), which is driven by a motor roller. This has a clockwise rotation direction

according to the diagram. Conveyor belt (27) returns the straw and tips it back to conveyor belt (21). Parts (24)-(26) can rise and fall and in this way regulate the quantity of straw going to the next conveyor belt (28). The regulation is controlled electronically with the aid of the measurement values given by the weighing unit (22) in conveyor belt (21) or else the weighing unit (29) in conveyor belt (28).

Conveyor belt (28) transports a loose string of straw (30) (not shown in the diagram) up to a strong standard blower (31). This blows the straw through a tube (32) to a nozzle (33). In this nozzle, a start plug of straw is placed in which the processing is started. It is so porous that air can pass, but not straw. The start plug is to capture the straw that is blown up by the blower (31) so that it does not get away uncontrolled. After the nozzle (33), there is a feed mechanism (41), shown in Figure 3, that also compresses the straw.

The feed mechanism (41) in Figure 4 consists of 2 frames (42) that are adjustable from a horizontal line with the aid of an adjustable leg (43). The feeding is done by a band (49) that runs over two large rollers (44), one of which is driven by a motor (45). A series of smaller rollers (46) supports the band between the large rollers. An tension arrangement (47) makes it possible to keep the band stretched. In the feed mechanism (41) the packed straw is drawn from the nozzle (33) and compressed horizontally. Vertical compressing takes place in an additional feed mechanism (48). This is similar to feed mechanism (41), but it is turned 90° with respect to it. Feed mechanism (48) also has another placement on the leg.

The straw is also transported through weighing units (22) and (28) and the return device (23) gives an even flow of straw to the blower (31) from band (28). After this, the blower blows air and straw and presses the straw into the nozzle (33). The turbulent current of the blower (31) makes the straw stalks have an unorganized structure in the nozzle (33). The feed mechanism (41) then draws and compresses the straw string continually. The speed of the feed mechanism is controlled by the quantity of straw from band (38), and the degree of compressing is determined by the dimensions of the nozzle (33) and the inclination of the frames (42) with respect to the horizontal position. In order to stop the supply of straw to the nozzle (33) in emergency situations, or in case of an incorrect flow, the tube (32) is provided with a throttle, This is linked by air jets to a side tube (35) that goes from tube (32) back to conveyor belt (27). (The throttle and tube are not drawn completely in the diagrams).

The supply of straw and the cold-compressing take place continually and give a straw string that hangs together. The string must then be cut to give a block. After cold-compressing, there is therefore a flying saw (50), Figure 3, that cuts the straw string up into blocks of a certain length, e.g. 1300 mm. The saw (50) consists, on the one hand, of a unit with a motor and a blade (51) that can be moved in the direction across the straw string with the aid of pneumatic or hydraulic cylinder, and, on the other hand, of a weighing unit (52) that can be driven in front of or behind the direction of the straw string and at the speed of the straw string with the aid of a ball screw and a servomotor (53). The speed of the servomotor is controlled on the basis of the speed of the /3

feed mechanism (41). The cut blocks are then fed in a long row into a microwave oven (60), Figure 5. This consists in principle of a feed unit consisting of a conveyor belt (62) that is driven by motor-driven rollers (71) and transmitters for microwaves. The oven (60) heats the blocks to about 100 °C. 7 blocks can be in the oven at the same time, and the first and last will prevent the microwaves from leaking out into the environment.

After the warming, the blocks are pushed into a press (70) with the aid of a hydraulic cylinder (71). In this, the blocks are compressed with the aid of hydraulic cylinders that press a side plate (72), an end plate (73), and a top plate (74) against fixed end positions. The front end plate (75) can be pushed sideways with the aid of a hydraulic cylinder (76). When the block is completely pressed, it is pushed out of the press-form space and into the form (80) with cylinders (73).

After the pressing, the block must be cooled, and in order to avoid shape changes, this is done in a form (80). This consists, e.g., of a rectangular aluminum tube with open ends with dimensions, e.g., 150x300 mm and length 120 mm. Since the cooling requires a relatively long time, several forms must be used at the same time. These are therefore circulated, and a system of hydraulic cylinders pushes [them] around the required movements. Cylinder (73) presses the block into the form (80). A stator (81) is located with the cylinders that pushes the forms sideways (82) and vertically (83). When the forms have made a cycle around, the blocks are pushed out of the forms with the aid of cylinder (84) onto a roller band (90).

In Figure 6, a suggestion is shown for a production for delivering blocks. From the roller band (90), the blocks are then loaded with the aid of a portal crane (91) onto a loading pallet (92). This is surrounded by plastic in a station (93). The plastic is then shrunk in a warming station (94). After this, the block is ready for delivery.

Claims

1. A method for producing building blocks of cold- and warm-compressed straw, characterized in that straw stalks are supplied in an unorganized structure, cold-compressed to a density higher than that of the loose straw and heated continually to a temperature suitable for the "adhesive properties." The warmed straw is compressed to a density much higher than that of the cold-compressed straw. This is done continuously or intermittently. The warm-compressed straw is allowed to cool in a form until it assumes a temperature a which the warm-compressed straw is stable enough that it can be taken out of the form without the shape of the block being changed.

2. A method according to Patent Claim 1, characterized in that the unorganized structure is obtained by a loose string of straw (30), with a known mass flow, is blown with the aid of a blower (31) that blows the loose straw into a form (33) and forms there a more compact string of straw is an unorganized structure. The straw string is moved continually and cold-compressed in the vertical direction by a feed mechanism (41). After feed mechanism (41), there is another feed mechanism (48) that cold-compresses the straw string horizontally.

3. A method for cold-compressing according to Patent Claim 2, characterized in that the feed mechanism consists of 2 frames (42) that are adjustable from a horizontal line, so that the straw is compressed successively when it is drawn through feed mechanism (41). Each frame (42) has a rod with rollers (46). This, in turn, collects onto a band (49). A roller on each frame has a mechanical drive (45).

4. A method for warming according to Patent Claim 1, characterized in that the straw string is warmed by passing continually through microwave units (62) or other heat sources or a straw string is heated by in stationary position in another way. /4

5. A method according to any of the above claims for warm-compressing of straw, characterized in that it can take place horizontally, vertically, or in both directions, done either continually in a feed mechanism (41) or intermittently in forms with movable walls (70) that can be pushed together.

6. A method for cooling according to any of the above claims, characterized in that the warm-compressed straw is cooled in forms that are fixed (80) or divisible.

Figure 1

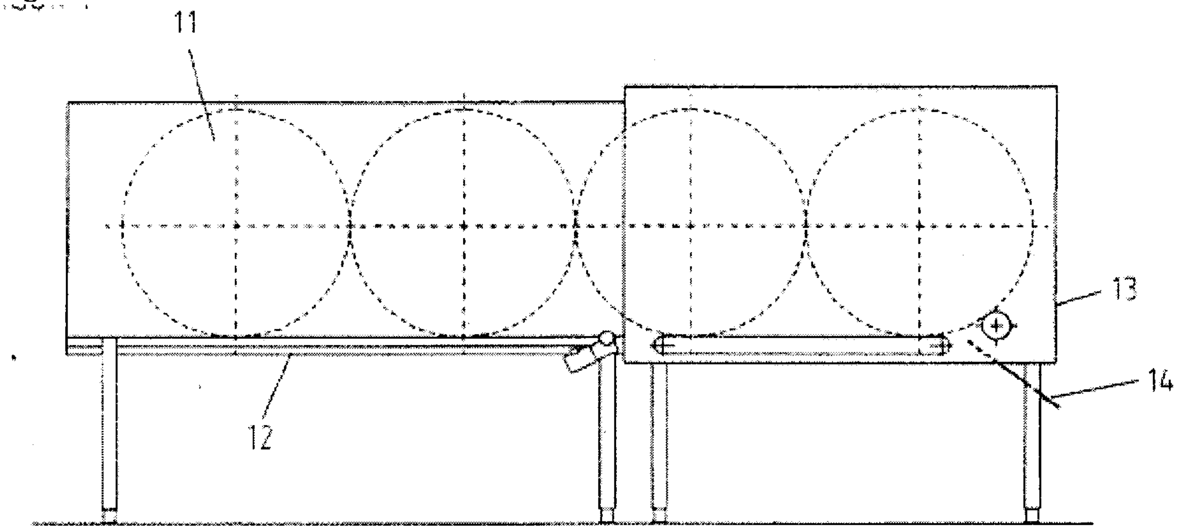


Figure 2

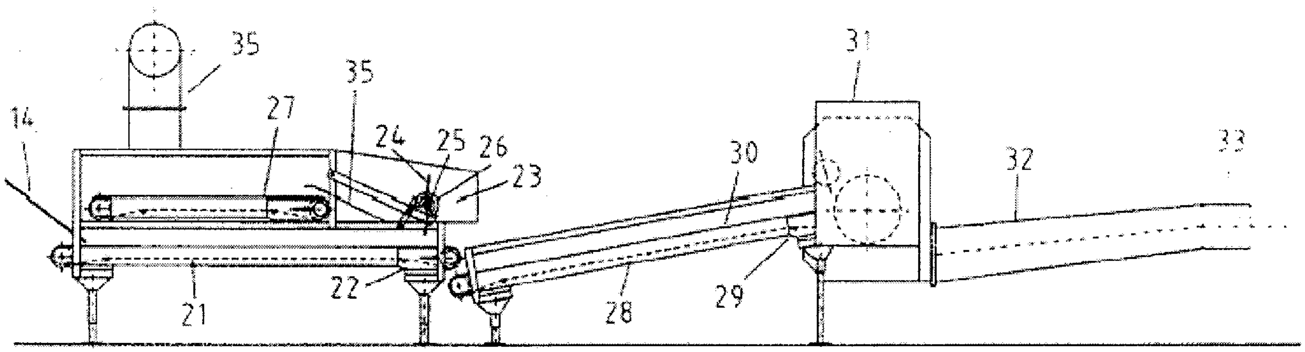


Figure 3

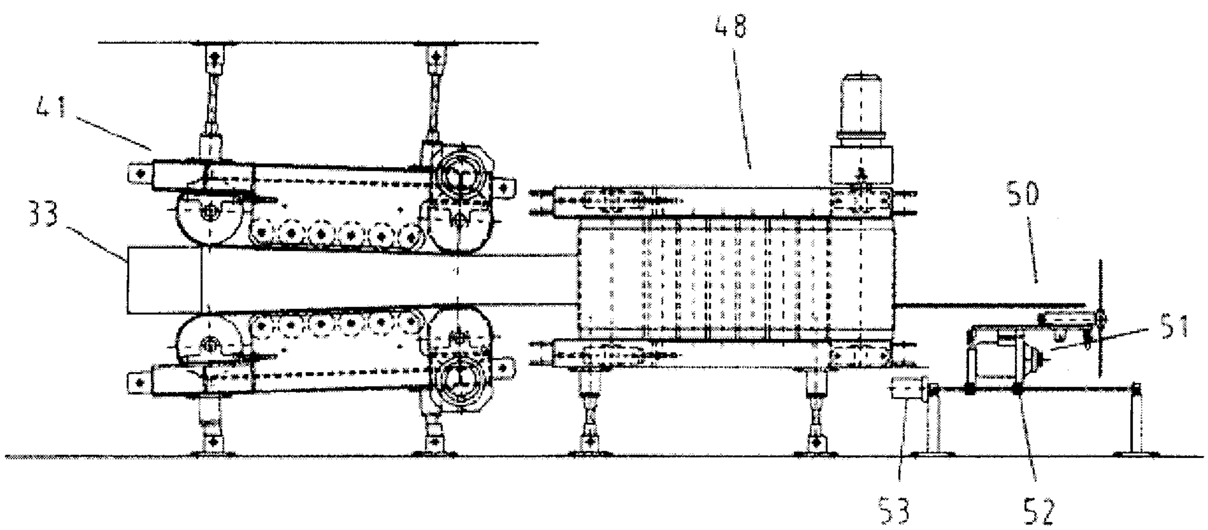


Figure 4

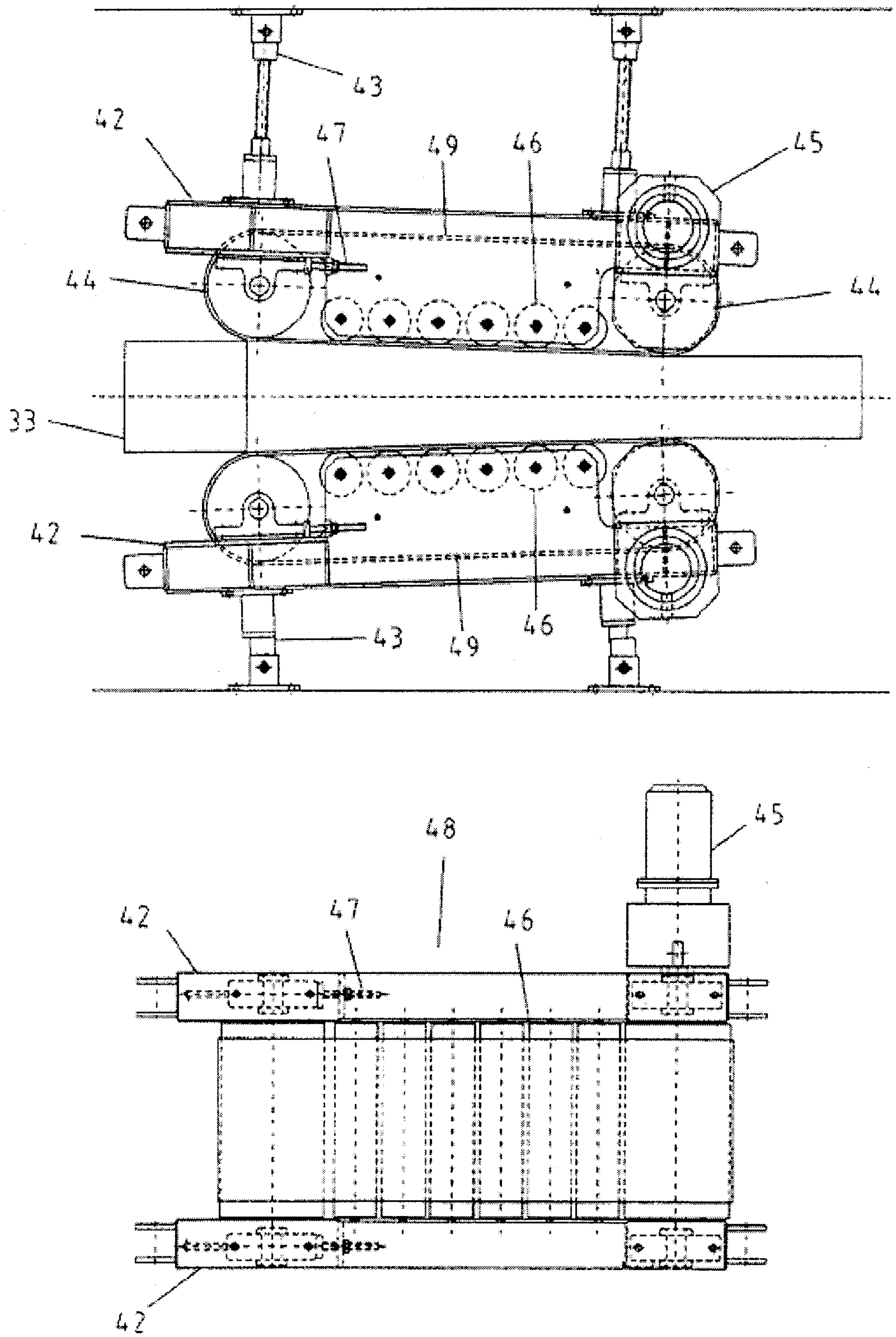
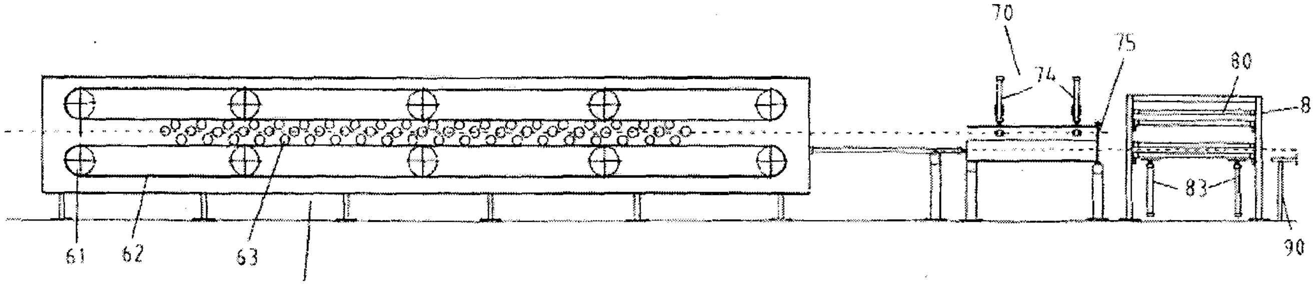


Figure 5



FIGUR 5

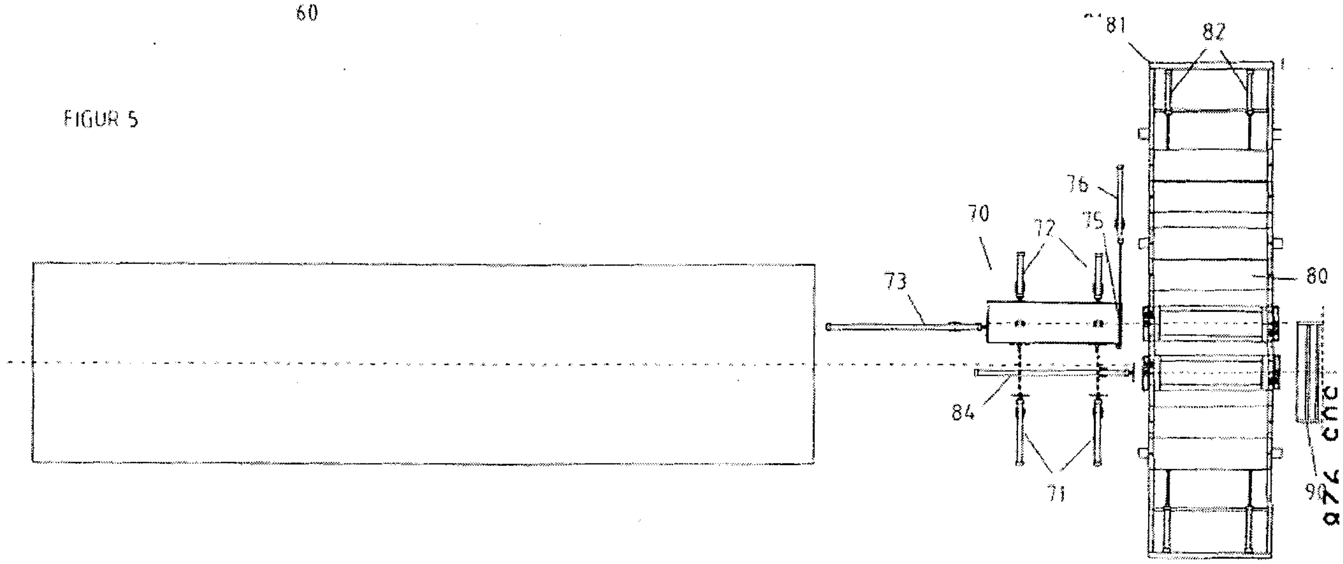


Figure 6